PART II - TEST PROCEDURES

PART II
CALIFORNIA EXHAUST AND PARTICULATE EMISSION TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

This part describes the equipment required and the procedures necessary to perform gaseous and particulate exhaust emission tests (40 CFR Part 86, Subpart B); cold temperature test procedures (40 CFR Part 86, Subpart C); the California 50°F test procedure; the development of reactivity adjustment factors, and the supplemental federal test procedure (40 CFR Part 86, Subpart B) on passenger cars, light-duty trucks and medium-duty vehicles.

A. 40 CFR Part 86, Subpart B- Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks; Test Procedures.

100.1 General applicability.

86.101 General applicability. June 28, 1977.
86.102 Definitions. March 5, 1980.
86.103 Abbreviations. March 5, 1980.
86.104 Section numbering, construction. April 11, 1989.
86.105 Introduction; structure of subpart. April 11, 1989.

100.2 Equipment and Facility Requirements.

86.106-00 Equipment required; overview. October 22, 1996.
86.107-98 Sampling and analytical system, evaporative emissions. August 23, 1995.
86.108-00 Dynamometer. October 22, 1996.
86.109-94 Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emission measurements. June 30, 1995.
86.110-94 Exhaust gas sampling system; diesel-cycle vehicles, and Otto-cycle vehicles requiring particulate emissions measurements. June 30, 1995.
86.111-94 Exhaust gas analytical-system. September 30, 1994.
86.112-91 Weighing chamber (or room) and microgram balance specifications. June 5, 1991.

100.3 Certification Fuel Specifications.

86.113-94 Fuel Specifications. June 30, 1995.

100.3.1 California Certification Gasoline Specification. Add the following subparagraph which reads: Gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in 86.113-94(a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

California Certification Gasoline Specifications		
Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2	91 (min)	D2699-88, D 2700-88
Sensitivity	7.5 (min)	D2699-88, D2700-88
Lead	0-0.01g/gal (max); no lead added	Title 13 CCR, §2253.4(c)
Distillation Range:		Title 13 CCR, §2263[c]
10% point	130-150 °F	
50% point [d]	200-210 °F	
90% point [e]	290-300 °F	
EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	30-40 ppm by wt.	Title 13 CCR, §2263
Phosphorous	0.005 g/gal (max)	Title 13 CCR, §2253.4(c)
RVP	6.7-7.0 psi	Title 13 CCR, §2263
Olefins	4.0-6.0 vol. %	Title 13 CCR, §2263
Total Aromatic Hydrocarbons	22-25 vol. %	Title 13 CCR, §2263
Benzene	0.8-1.0 vol. %[f]	Title 13 CCR, §2263
Multi-substituted Alkyl Aromatic Hydrocarbons	12-14 vol. %[g]	
MTBE	10.8-11.2 vol. %	Title 13 CCR §2263
Additives	Sufficient to meet requirements of Title 13 CCR §2257	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [h]	
Heat of Combustion	Report [h]	
Carbon	Report wt. % [h]	
Hydrogen	Report wt. % [h]	

[a] The gasoline must be blended from typical refinery feedstocks.

[b] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[c] Although Title 13 CCR § 2263 refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[d] The range for interlaboratory testing is 195-215° F.

[e] The range for interlaboratory testing is 285-305° F.

[f] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[g] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[h] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

100.3.2 Certification Diesel Fuel Specifications

Amend subparagraphs §86.113-94(b)(2) and (b)(3) as follows:

(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 40 CFR §86.113-94(b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel, shall be used. The petroleum fuel used in exhaust emission testing may meet the specfiications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in 40 CFR §86.113-94(b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of 86.113-94(b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

California Certification Diesel Fuel Specifications

Fuel Property	Limit	Test Method [a]
Natural Cetane Number	47-55	D 613-86
Distillation Range		Title 13, CCR, §2282(g)(3)
IBP	340-420 °F	
10% point	400-490 °F	
50% point	470-560 °F	
90% point	550-610 °F	
EP	580-660 °F	
API Gravity	33-39°	D 287-82
Total Sulfur	0.01-0.05 wt. %	Title 13, CCR, §2282(g)(3)
Nitrogen Content	100-500 ppmw	Title 13, CCR, §2282(g)(3)

Fuel Property	Limit	Test Method [(a)]
Total Aromatic Hydrocarbons	8-12 vol. %	Title 13, CCR, §2282(g)(3)
Polycyclic Aromatic Hydrocarbons	1.4 wt. % (max)	Title 13, CCR, §2282(g)(3)
Flashpoint	130 °F (max)	D 93-80
Viscosity @ 40°F	2.0-4.1 centistokes	D 445-83

[(a)] ASTM specifications unless otherwise noted. A reference to a subsection of Title 13, CCR, §2282 means the test method identified in that subsection for the particular property. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results of the specified method.

(3) Diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

100.3.3 Alcohol Fuels

Amend §86.113-94(c) as follows:

Delete subparagraphs (c)(1) and (c)(2); replace with:

(c)(1) **Emission test fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust and evaporative emission testing shall meet the specifications set forth in Title 13, CCR, Section 2292.1 (Specifications for M-100 Fuel Methanol) or Section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

Specification	Limit
M-100 Fuel Methanol	
Methanol	98.0 ± 0.5 vol. percent
Ethanol	1.0 ± 0.1 vol. percent
Petroleum fuel meeting the specifications of section 100.3.1.	1.0 ± 0.1 vol. percent
E-100 Fuel Ethanol	
Ethanol	98.0 ± 0.5 vol. percent
Methanol	1.0 ± 0.1 vol. percent
Petroleum fuel meeting the specifications of section 100.3.1.	1.0 ± 0.1 vol. percent

(c)(2) **Mileage accumulation fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol

fuel used for service accumulation shall meet the applicable specifications set forth in Title 13, CCR, Section 2292.1 (Specifications for M-100 Fuel Methanol) or Section 2292.3 (Specification for E-100 Fuel Ethanol).

(c)(3) Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

100.3.4 Mixtures of Petroleum and Alcohol Fuels for Flexible Fuel Vehicles

Amend §86.113-94(d) as follows:

Delete subparagraphs (d)(1) and (d)(2); replace with:

(d)(1) **Exhaust emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust emission testing shall meet the applicable specifications set forth in Title 13, CCR, Section 2292.2 (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) as modified by the following:

Specification	Limit
M-85 Fuel Methanol	
Petroleum fuel meeting the specifications of section 100.3.1.	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.
E-85 Fuel Methanol	
Petroleum fuel meeting the specifications of section 100.3.1.	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

(d)(2) **Mileage accumulation fuel.** ~~For both durability-data vehicles and emission-data vehicles, mileage accumulation shall be conducted with one fuel~~. For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel specified in Part II, Sections A.100.3.1 or 100.3.2 and methanol or ethanol fuel shall meet the applicable specifications set forth in Title 13, CCR, Section 2292.2 (Specifications for M-85 Fuel Methanol) or Section 2292.4 (Specification for E-85 Fuel Ethanol). The fuels shall be alternated at mileage intervals not to exceed 5,000 miles. Alternative mileage accumulation fuels ~~and procedures~~ may be used if demonstrated to result in equivalent or more severe deterioration of the vehicle's emission control system, subject to the prior approval of the Executive Officer.

(d)(3) **Evaporative emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, a blend of methanol or ethanol fuel used for evaporative emission testing shall meet the applicable specifications set forth in Title 13, CCR, section 2292.2 (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) and gasoline meeting the specifications of section 100.3.1 of these test procedures such that the final blend is composed of either 35 volume percent methanol (± 1.0 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (± 1.0 volume percent of total blend) for ethanol-fueled vehicles. Alternative alcohol-gasoline blends may be used in place of M35 or E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to prior approval of the Executive Officer.

(d)(4) **Additive requirements.** Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

100.3.5 Natural Gas Fuels

Amend §86.113-94(e) as follows:

Delete subparagraphs (e)(1), (e)(2) and (e)(3); replace with:

(e)(1) **Exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in Title 13, CCR, Section 2292.5 (Specifications for Compressed Natural Gas) as modified by the following:

Specification	Limit
Compressed Natural Gas Certification Test Fuel	
Methane	90.0 ± 1.0 mole percent
Ethane	4.0 ± 0.5 mole percent
C_3 and higher hydrocarbon content	2.0 ± 0.3 mole percent
Oxygen	0.5 mole percent maximum
Inert gases (CO_2 + N_2)	3.5 ± 0.5 vol. percent

(e)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for service accumulation shall meet the specifications listed in Title 13, CCR, Section 2292.5 (Specifications for Compressed Natural Gas).

100.3.6 Liquefied Petroleum Gas Fuels

Amend §86.113-94(f) as follows:

Delete subparagraphs (f)(1) and (f)(2); replace with:

(f)(1) **Evaporative and exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in Title 13, CCR, Section 2292.6 (Specifications for Liquefied Petroleum Gas) as modified by the following:

Specification	Limit
Liquefied Petroleum Gas Certification Test Fuel	
Propane	93.5 ± 1.0 volume percent
Propene	3.8 ± 0.5 volume percent
Butane and heavier components	1.9 ± 0.3 volume percent

(f)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for service accumulation shall meet the specifications listed in Title 13, CCR, Section 2292.6 (Specifications for Liquefied Petroleum Gas).

100.3.7 Identification of New Clean Fuels to be Used in Certification Testing

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraph 86.113-94 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels." In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel sold commercially in California.

86.114-94 Analytical gases. June 30, 1995.
86.115-00 EPA urban dynamometer driving schedules. October 22, 1996.

100.4 Calibration methods and frequency.

86.116-94 Calibrations, frequency and overview. April 11, 1989.
86.117-96 Evaporative emission enclosure calibrations. August 23, 1995.
86.118-00 Dynamometer calibrations. October 22, 1996.
86.119-90 CVS calibration. June 30, 1995.
86.120-94 Gas meter or flow instrumentation calibration, particulate, methanol and formaldehyde measurement. June 30, 1995.
86.121-90 Hydrocarbon analyzer calibration. June 30, 1995.
86.122-78 Carbon monoxide analyzer calibration. June 28, 1977.
86.123-78 Oxides of nitrogen analyzer calibration. June 30, 1995.
86.124-78 Carbon dioxide analyzer calibration. June 28, 1977.
86.125-94 Methane analyzer calibration. June 5, 1991.
86.126-90 Calibration of other equipment. April 11, 1989.

100.5 Test Procedures and Data Requirements.
86.127-00 Test procedures; overview. October 22, 1996.
86.128-00 Transmissions. October 22, 1996.
86.129-00 Road load power, test weight, inertia weight class determination, and fuel temperature profile. October 22, 1996.

100.5.1 California Road Load Power, Test Weight and Inertia Weight Class Determination.

100.5.1.1 Amend §86.129-00(a) to add the following specifications for medium-duty vehicles:

ROAD LOAD POWER @ 50 mph FOR MEDIUM-DUTY VEHICLES		
ADJUSTED LOADED VEHICLE WEIGHT (lbs.)	EQUIVALENT TEST WEIGHT (lbs.)	INERTIA WEIGHT CLASS (lbs.)
10001 to 10250	10000	10000

ADJUSTED LOADED VEHICLE WEIGHT (lbs.)	EQUIVALENT TEST WEIGHT (lbs.)	INERTIA WEIGHT CLASS (lbs.)
10251 to 10750	10500	10500
10751 to 11250	11000	11000
11251 to 11750	11500	11500
11751 to 12250	12000	12000
12251 to 12750	12500	12500
12751 to 13250	13000	13000
13251 to 13750	13500	13500
13751 to 14000	14000	14000

100.5.1.2 Amend §86.129-00(b) to add the following specifications for medium-duty vehicles: **Power absorption unit adjustment- medium-duty vehicles.**

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 miles per hour true speed. The dynamometer power absorption shall take into account the dynamometer friction, as discussed in paragraph 86.118-78.

(2) The dynamometer road load setting is determined from the loaded test weight, the reference frontal area, vehicle protuberances, and an aerodynamic drag coefficient as determined appropriate by the Executive Officer. The vehicle manufacturer shall submit the procedure by which the aerodynamic drag coefficient was determined in the test vehicle information section in the certification application. The dynamometer road load setting shall be determined by the following equation.

(i) For medium-duty vehicles to be tested on twin or single large roll dynamometers:

$$Hp = (0.00182)V((0.015)(W)+(0.0375)(Cd)(A)(V^2)/(32.2 ft/s^2))+P$$

where:

Hp = the dynamometer power absorber setting at 50 mph (horsepower).
0.00182 = conversion factor to horsepower.
V = velocity in feet/sec.
0.015 = coefficient of rolling resistance.
W = loaded vehicle weight in pounds.
0.0375 = air density in lbm/cubic ft.
Cd = aerodynamic drag coefficient.
A = reference frontal area in square ft.
32.2 ft/s^2 = gravitational acceleration
P = protuberance power (horsepower)

(ii) The protuberance power, P shall be determined per subparagraph 86.129-80(c)(2)(i).
(iii) The dynamometer power absorber setting for medium-duty vehicles shall be rounded to the nearest 0.1 horsepower.

(3) The road load power calculated above shall be used or the vehicle manufacturer may determine the road load power by an alternate procedure requested by the manufacturer and approved in advance by the Executive Officer.

(4) Where it is expected that more than 33 percent of a vehicle line within an engine-system combination will be equipped with air conditioning, per §86.1828-01, the road load power as determined in paragraph (2) or (3) of this section shall be increased by 10 percent up to a maximum increment of 1.4 horsepower, for testing all test vehicles of that vehicle line within that engine-system combination if those vehicles are intended to be offered with air conditioning in production. This power increment shall be added to the indicated dynamometer power absorption setting prior to rounding off this value.

86.130-00 Test sequence; general requirements. October 22, 1996.

100.5.2 California test sequence; general requirements

100.5.2.1 Delete subparagraph (a) of §86.130-00 and replace with:

For purposes of determining conformity with 50°F test requirements, the procedures set forth in Part II, Section C. For all hybrid electric vehicles and all 2001 and subsequent model-year vehicles certifying to running loss and useful life evaporative emission standards, the test sequence specified in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR shall apply. of these test procedures shall apply.

100.5.2.2 Add the following:

A manufacturer has the option of simulating air conditioning operation during testing at other ambient test conditions provided it can demonstrate that the vehicle tailpipe exhaust emissions are representative of the emissions that would result from the SC03 cycle test procedure and the ambient conditions of paragraph 86.161-00. The Executive Officer has approved two optional air conditioning test simulation procedures, AC1 and AC2, for the 2001 to 2003 model years only. If a manufacturer desires to conduct an alternative SC03 test simulation other than AC1 and AC2, or the AC1 and AC2 simulations for the 2004 and subsequent model years, the simulation test procedure must be approved in advance by the Executive Officer (see paragraphs 86.162-00 and 86.162-03).

86.131-00 Vehicle preparation. October 22, 1996.

86.132-00 Vehicle preconditioning. October 22, 1996

100.5.3 California Vehicle Preconditioning Requirements

100.5.3.1 Add the following subparagraph: For all hybrid electric vehicles and all 2000 and subsequent model-year vehicles subject to running loss and useful life evaporative

emission standards, the preconditioning sequence for the Federal Test Procedure specified in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR shall apply. In addition, the preconditioning sequence for the SFTP described in subparagraphs (n) and (o) of paragraph 86.132-00 shall apply.

86.133-96 Diurnal breathing loss test. August 23, 1995.
86.134-96 Running loss test. August 23, 1995.
86.135-00 Dynamometer procedure. October 22, 1996.
86.136-90 Engine starting and restarting. September 21, 1994.
86.137-96 Dynamometer test run, gaseous and particulate emissions. March 24, 1993.
86.138-96 Hot soak test. August 23, 1995.
86.139-90 Diesel particulate filter handling and weighing. April 11, 1989.
86.140-94 Exhaust sample analysis. June 30, 1995.
86.142-90 Records required. June 30, 1995.
86.143-96 Calculations; evaporative emissions. August 23, 1995.

86.144-94 Calculations; exhaust emissions. July 5, 1991.

100.5.4 Calculations; exhaust emissions

100.5.4.1 The exhaust emission calculations for California are set forth in the "California Non-Methane Organic Gas Test Procedures, as incorporated by reference herein.

100.5.4.2 Add the following calculation:

Organic material non-methane hydrocarbon equivalent mass for ethanol vehicles:

$$OMNMHCE_{mass} = NMHC_{mass} + (13.8756/32.042) \times (CH_3OH)_{mass} + (13.8756/23.035) \times (CH_3CH_2OH)_{mass} + (13.8756/30.0262) \times (HCHO)_{mass} + (13.8756/22.027) \times (CH_3CHO)_{mass}$$

86.145-82 Calculations; particulate emissions. November 2, 1982.
86.158-00 Supplemental Federal Test Procedures; overview. October 22, 1996.
86.159-00 Exhaust emission test procedures for US06 emissions. October 22, 1996.
86.160-00 Exhaust emission test procedure for SC03 emissions. October 22, 1996.
86.161-00 Air conditioning environmental test facility ambient requirements. October 22, 1996.
86.162-00 Approval of alternative air conditioning test simulations and descriptions of AC1 and AC2. October 22, 1996.
86.162-03 Approval of alternative air conditioning test simulations. October 22, 1996.
86.163-00 Spot check correlation procedures for vehicles tested using a simulation of the environmental test cell for air conditioning emission testing. October 22, 1996.
86.164-00 Supplemental federal test procedure calculations. October 22, 1996.

B. Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles and New Light-Duty Trucks; Cold Temperature Test Procedures

86.201-94 General applicability. July 17, 1992.

200.1 California applicability.

Amend subparagraph 86.201-94(a) as follows: This subpart describes procedures for determining the cold temperature carbon monoxide (CO) emissions from 2000 and later model year new passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas vehicles, diesel-fueled vehicles, ~~hybrid electric vehicles,~~ and zero-emission vehicles).

86.202-94 Definitions. July 17, 1992.
86.203-94 Abbreviations. July 17, 1992.
86.204-94 Section number construction. July 17, 1992.
86.205-94 Introduction; structure of subpart. July 17, 1992.
86.206-94 Equipment required; overview. July 17, 1992.

200.2 California Equipment Required; Overview

Amend §86.206-94, as follows:

This subpart contains procedures for exhaust emission tests on passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas vehicles, diesel-fueled vehicles, ~~hybrid electric vehicles,~~ and zero-emission vehicles.) Equipment required and specifications are as follows:

(a)(1) **Exhaust emission tests**. Exhaust from vehicles (excluding natural gas vehicles, diesel-fueled vehicles, ~~hybrid electric vehicles,~~ and zero-emission vehicles) is tested for gaseous emissions using the Constant Volume Sampler (CVS) concept (§86.209). Equipment necessary and specifications appear in 40 CFR Part 86, §§86.208 through 86.214.

(a)(2) **Fuel, analytical gas, and driving schedule specifications**. Fuel specifications for exhaust emission testing for gasoline-fueled vehicles are specified in 40 CFR Part 86, §86.213. Fuel specifications for exhaust emission testing for alcohol-fueled vehicles and liquefied petroleum gas vehicles are specified in Part II, Section 100.3 of these test procedures. Analytical gases are specified in 40 CFR Part 86, §86.214. The EPA Urban Dynamometer Driving Schedule (UDDS) for use in emission tests is specified in 40 CFR Part 86, §86.215 and appendix I to this part.

86.208-94 Dynamometer. July 17, 1992.
86.209-94 Exhaust gas sampling system; gasoline-fueled vehicles. July 17, 1992.
86.211-94 Exhaust gas analytical system. July 17, 1992.
86.213-94 Fuel specifications. July 17, 1992.
86.214-94 Analytical gases. July 17, 1992.
86.215-94 EPA urban dynamometer driving schedule. July 17, 1992.

86.216-94 Calibrations, frequency and overview. July 17, 1992.
86.218-94 Dynamometer calibration. July 17, 1992.
86.219-94 CVS calibration. July 17, 1992.
86.221-94 Hydrocarbon analyzer calibration. July 17, 1992.
86.222-94 Carbon monoxide analyzer calibration. July 17, 1992.
86.223-94 Oxides of nitrogen analyzer calibration. July 17, 1992.
86.224-94 Carbon dioxide analyzer calibration. July 17, 1992.
86.226-94 Calibration of other equipment. July 17, 1992.
86.227-94 Test procedures; overview. July 17, 1992.
86.228-94 Transmissions. July 17, 1992.
86.229-94 Road load force, test weight, and inertia weight class determination. July 17, 1992.
86.230-94 Test Sequence; general requirements. July 17, 1992.
86.231-94 Vehicle Preparation. July 17, 1992.
86.232-94 Vehicle Preconditioning. July 17, 1992.
86.235-94 Dynamometer procedure. July 17, 1992.
86.236-94 Engine starting and restarting. July 17, 1992.
86.237-94 Dynamometer test run, gaseous emissions. July 17, 1992.
86.240-94 Exhaust sample analysis. July 17, 1992.
86.242-94 Records required. July 17, 1992.
86.244-94 Calculations; exhaust emissions. July 17, 1992.
86.246-94 Intermediate temperature testing. July 17, 1992.

Appendix I to Part 86 -- Urban Dynamometer Schedules. October 22, 1996.

C. 50EF Emission Test Procedure.

The NMOG, CO, NOx and formaldehyde emissions from all light- and medium-duty TLEVs, LEVs, ULEVs and SULEVs shall be measured according to the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86 at a nominal temperature of 50 ºF with the following modifications:

(1) **Test Procedure.**

(a) The test vehicles shall not be subject to a diurnal heat build prior to the cold start exhaust test or evaporative emission testing.

(b) Following a 12 to 36 hour cold soak at a nominal temperature of 50EF, ~~For the 50EF emission test~~, the nominal preconditioning, soak, and test temperatures shall be maintained within 3EF of the nominal temperature on an average basis and within 5EF of the nominal temperature on a continuous basis. The temperature shall be sampled at least once every 15 seconds during the preconditioning and test periods and at least once each 5 minutes during the soak period. A continuous strip chart recording of the temperature with these minimum time resolutions is an acceptable alternative to employing a data acquisition system.

(c) The test site temperature shall be measured at the inlet of the vehicle cooling fan used for testing.

(d) The test vehicle may be fueled before the preconditioning procedure in a fueling area maintained within a temperature range of 68 to 86EF. ~~The preconditioning shall be conducted at a nominal temperature of 50EF.~~ The requirement to saturate the evaporative control canister(s) shall not apply.

(e) If a soak area remote from the test site is used, the vehicle may pass through an area maintained within a temperature range of 68 to 86E F during a time interval not to exceed 10 minutes. In such cases, the vehicle shall be restabilized to 50EF by soaking the vehicle in the nominal 50EF test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.

(f) The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.

D. Procedure for Determining Specific Reactivity.

The following procedure shall be used by the Executive Officer to establish reactivity adjustment factors for exhaust emissions of non-methane organic gases (NMOG) for the purpose of certifying a vehicle of specific emission category and fuel for sale in California.

1. Procedure for Determining Specific Reactivity.

(a) A representative speciated NMOG exhaust emission profile for light- and medium-duty low-emission vehicles shall be established according to the following conditions:

i. Speciated NMOG profiles shall be obtained from a statistically valid number of vehicles in each vehicle emission category and fuel type. The maximum incremental reactivities to be used are provided in the "California Non-Methane Organic Gas Test Procedures," incorporated by reference herein.

ii. The speciated NMOG profiles shall identify and quantify, in units of grams per mile or milligrams per mile, ~~as many organic compounds as possible~~ all compounds above the specified laboratory limit of detection as measured in accordance with the procedures specified in the "California NMOG Test Procedures."

(b) The "grams ozone per mile" value of each organic compound identified in the speciated profile shall be determined by multiplying the "grams per mile NMOG" emission value of each compound by the applicable maximum incremental reactivity value as specified in the “California Non-Methane Organic Gas Test Procedures.”

(c) The "total grams ozone per mile" of NMOG exhaust emissions from each vehicle emission category and fuel type shall be the sum of all the organic compounds values calculated in step (b).

(d) The specific reactivity of each vehicle emission category and fuel type shall be determined by dividing the "total grams ozone per mile" value calculated in step (c) by the "total grams per mile of NMOG emissions."

2. Procedure for Determining Reactivity Adjustment Factors.

(a) The baseline specific reactivity of vehicle emission categories operating on conventional gasoline shall be determined by the Executive Officer in accordance with the procedure outlined in subparagraph 1., above.

i. Gasoline meeting the specifications listed below shall be used to determine the baseline specific reactivity low-emission vehicles operating on conventional gasoline:

Specifications for Conventional Gasoline	
Fuel Property	**Limit**
Sulfur	300 ± 50 ppm by weight
Benzene	1.6 ± 0.3 volume percent

Reid vapor pressure	8.7 ± 0.3 psi
Distillation, D-86, ^{o}F	
10%	115-135
50%, maximum	240
90%,	323-333
EP, maximum	420
Hydrocarbons	
Total Aromatics	32 ± 3.0 volume percent
Multi-substituted alkyl aromatics	21 ± 3.0 volume percent
Olefins	12 ± 3.0 volume percent
Saturates	Remainder

(The test methods used for each fuel property shall be the same as the test method for the identical fuel property listed in Part II, Section 100.3 of these test procedures.)

(b) The generic specific reactivity of vehicle emission categories operating on clean fuels shall also be determined by the Executive Officer according to the procedure outlined in subparagraph 1. above.

(c) The candidate vehicle/fuel "reactivity adjustment factor" shall be determined by dividing the specific reactivity of a candidate fuel and vehicle by the baseline specific reactivity of vehicles in the same vehicle emission category using the procedure outline in subparagraph 1. above.

(d) For a candidate vehicle/fuel system operating on natural gas, a “methane reactivity adjustment factor” shall be calculated by dividing the maximum incremental reactivity value for methane given in the California Non-Methane Organic Gas Test Procedures by the specific reactivity for the vehicle in the same emission control technology category operated on conventional gasoline as listed in subparagraph (a)i. above or established by the Executive Officer pursuant to paragraph 4 and 5 below. The current methane reactivity adjustment factors are listed in Part I.E.4 of these test procedures.

3. Procedures for Establishing Test Group Specific Reactivity Adjustment Factors. A manufacturer may request the use of a unique specific reactivity for a specific vehicle test group category and fuel. The Executive Officer shall approve such a request provided the criteria outlined below are met.

(a) The manufacturer submits speciated NMOG exhaust emission profiles to the Executive Officer obtained from emission testing a minimum of four different vehicles

representative of vehicles that will be certified in the test group. The test vehicles shall include the official emission-data vehicle(s) for the engine family, and the mileage accumulation of each vehicle shall be at or greater than 4000 miles. One speciated profile shall be submitted for each test vehicle. Emission levels of each constituent NMOG shall be measured according to the "California Non-Methane Organic Gas Test Procedures." For the emission-data vehicle(s), the speciated profile(s) shall be obtained from the same test used to obtain the official exhaust emission test results for the emission-data vehicle at the 4,000 mile test point. The manufacturer shall calculate specific reactivity for each speciated NMOG exhaust emission profile in accordance with the procedures specified in paragraph 2. above. By using these specific reactivity values, the manufacturer shall calculate a "reactivity adjustment factor" for each test vehicle in accordance with the procedure specified in paragraph 3. above. A "reactivity adjustment factor" for the test group shall be calculated by taking the arithmetic mean of the "reactivity adjustment factor"' obtained for each test vehicle. The 95 percent upper confidence bound (95% UCB) shall be calculated according to the equation:

$$95\%\ UCB = RAF + 1.96 \times \left[\sum_{I=1}^{n} (RAF_i - RAF_m)^2 / (n-1) \right]^{1/2}$$

where:

RAF_m = mean "reactivity adjustment factor" calculated for the test group
RAF_i = "reactivity adjustment factor" calculated for the i'th test vehicle
n = number of test vehicles

The 95 percent upper confidence bound of the “reactivity adjustment factor” for the test group shall be less than or equal to 115 percent of the test group “reactivity adjustment factor.”

(b) The manufacturer submits an "ozone deterioration factor" for the test group. To determine the "ozone deterioration factor," the manufacturer shall perform two tests at each mileage interval for one or more durability vehicle(s) tested in accordance with the procedures and conditions for calculating mass deterioration factors specified in Part I, Section F.3 (40 CFR §86.1819) of these test procedures. The Executive Officer shall approve the use of other mileage intervals and procedures if the manufacturer can demonstrate that equivalently representative "ozone deterioration factors" are obtained. One speciated profile shall be submitted for each test. Emission levels of each constituent NMOG shall be measured according to the "California Non-Methane Organic Gas Test Procedures. A mean gram per mile NMOG mass value and a mean specific reactivity value shall be calculated by taking the arithmetic mean of each measurement from the speciated profiles. These results shall be multiplied together to obtain a mean "total grams ozone per mile" value at each mileage interval. A mean "ozone deterioration factor" shall be calculated in accordance with the procedures in Part I Section F.3 (40 CFR §86.1819) of these test procedures except that the mean total "grams ozone per mile" value determined at each mileage interval shall be used in place of measured mass emissions. If the "ozone deterioration factor" is determined to be less than 1.00, the "ozone deterioration factor" shall be assigned a value of 1.00. The "ozone

deterioration factor" shall be multiplied by the product of the official exhaust NMOG mass emission results at the 4,000 mile test point and the mean "reactivity adjustment factor" for the test group to obtain the NMOG certification levels used to determine compliance with the NMOG emission standards.

(c) The speciated profiles, mean "reactivity adjustment factor" for the test group, and "ozone deterioration factor" are provided to the Executive Officer with the certification application for the engine family.

(d) The maximum incremental reactivities to be used are provided in the "California Non-Methane Organic Gas Test Procedures." Any manufacturer which intends to use the table shall submit to the Executive Officer a list which provides the specific organic gases measured by the manufacturer and the maximum incremental reactivity value assigned to each organic gas prior to or with the submittal of a request for the use of a reactivity adjustment factor unique to a specific test group. The Executive Officer may deny such requests if he or she determines that the maximum incremental reactivity value assignments are made incorrectly.

4. Procedure for Establishing A New Reactivity Adjustment Factor. The Executive Officer may establish by executive order new reactivity adjustment factor pursuant to the procedures set forth above. The Executive Officer shall notify manufacturers in writing of a new reactivity adjustment factor within 30 days of their establishment.

5. Procedure for Revising A Reactivity Adjustment Factor. The Executive Officer may revise any reactivity adjustment factor listed in Part I.E.5 of these test procedures or established by the Executive Officer pursuant to the above criteria if he or she determines that the revised reactivity adjustment factor is more representative of the ozone-forming potential of vehicle NMOG emissions based on the best available scientific knowledge and sound engineering judgment. The Executive Officer shall notify manufacturers in writing of any such reactivity adjustment factor at least 3 years prior to January 1 of the calendar year which has the same numerical designation as the model year for which the revised reactivity adjustment factor first becomes effective. However, a manufacturer may use the revised reactivity adjustment factor in certifying any new test group whose certification application is submitted following such notification, if it so chooses. A manufacturer may also continue to use the original reactivity adjustment factor for any existing test group previously certified with that reactivity adjustment factor until a new durability-data vehicle is tested for that test group.